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II. **Solution by COOPER D. SCHMITT, M. A., Professor of Mathematics, University of Tennessee, Knoxville, Tenn.; and Professor CHAS. C. CROSS, Laytonsville, Md.**

By the conditions we have at once the five equations; letting x, y, z, u, t, $=A$, B, C, D, E, and F's shares, respectively:

$$\begin{aligned}
&x+ay+az+au+at=m,\\
&bx+y+by+bu+bt=n,\\
&cx+cy+z+cu+ct=p,\\
&dx+dy+dz+u+dt=q,\\
&ex+ev+ez+eu+t=r.
\end{aligned}$$

Hence by Determinants,

$$x=\begin{vmatrix} m & a & a & a & a \\ n & 1 & b & b & b \\ p & c & 1 & c & c \\ q & d & d & 1 & d \\ r & e & e & e & 1 \end{vmatrix} \div \begin{vmatrix} 1 & a & a & a & a \\ b & 1 & b & b & b \\ c & c & 1 & c & c \\ d & d & d & 1 & d \\ e & e & e & e & 1 \end{vmatrix},$$

$$y=\begin{vmatrix} 1 & m & a & a & a \\ b & n & b & b & b \\ c & p & 1 & c & c \\ d & q & d & 1 & d \\ e & r & e & e & 1 \end{vmatrix} \div \begin{vmatrix} 1 & a & a & a & a \\ b & 1 & b & b & b \\ c & c & 1 & c & c \\ d & d & d & 1 & d \\ e & e & e & e & 1 \end{vmatrix},$$

and so with z, u, and t, each determinant possessing 120 terms, when expanded.

* * *

GEOMETRY.

Conducted by **B. F. FINKEL, Springfield, Mo.** All contributions to this department should be sent to him.

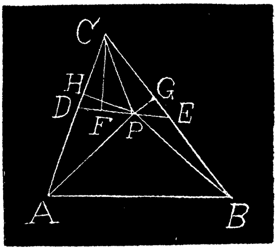
SOLUTIONS OF PROBLEMS.

76. **Proposed by L. B. FRAKER, Bowling Green, Ohio.**

Lines run from a point, P, within a triangular piece of land to the angles A, B, and C are 91, 102, and 80 rods, respectively; and a line 78 rods in length passing through the point, P, and terminating in the sides AC and BC cuts off 3024 square rods adjacent to angle C. Required the dimensions of the land.

Solution by CHAS. C. CROSS, Laytonsville, Md.

Let ABC be the required triangle, $AP=a=91$ rods, $BP=b=102$ rods, $CP=c=80$ rods, $DE=d=78$ rods, the line drawn through P and cutting off 3024 square rods adjacent to the angle C, $CD=x$, $CE=y$, $PE=z$, and area of triangle $DEC=k$.



Draw the perpendiculars PG and PH, from the point P to the sides BC and AC respectively, and draw CF perpendicular to DE. Then

$$x^2=y^2+d^2\pm 2d\times FE, \text{ whence}$$

$$FE=\frac{y^2+d^2-x^2}{2d}. \quad \text{Also } FE=\pm\sqrt{y^2-\frac{4k^2}{d^2}}.$$

$$\text{Hence, } \mp\frac{y^2+d^2-x^2}{2d}=\pm\sqrt{y^2-\frac{4k^2}{d^2}},$$

whence $-(x^2-y^2)^2+2d^2(x^2+y^2)=16k^2+d^2$, an equation containing two unknown quantities. Hence since no other conditions are given by which x or y can be found, it follows that the problem is indeterminate.

By trial, we find that $x=90$ and $y=84$ satisfies the above equation.

Hence, these values furnish a solution, in positive integers, of the problem. Then

$$PF=\sqrt{c^2-\frac{4k^2}{d^2}}=19\tfrac{9}{13} \text{ rods, and } FE=\sqrt{y^2-\frac{4k^2}{d^2}}=32\tfrac{4}{13} \text{ rods.}$$

Hence, $z=PF+FE=52$ rods.

$$BG=\frac{b^2+BC^2-c^2}{2BC} \text{ and } CG=\frac{c^2+y^2-z^2}{2y}. \quad \text{But } BG+CG=BC. \quad \text{Hence,}$$

$$BC=\frac{c^2+y^2-z^2\pm\sqrt{4(b^2-c^2)y^2+(c^2+y^2-z^2)^2}}{2y}=154 \text{ rods.}$$

By similar reasoning with the triangles APC and DPC, we find that $AC=165$ rods.

$$\cos ACB=(90^2+84^2-18^2)\div 2.90.84=\tfrac{3}{5}.$$

$$AB=\sqrt{AC^2+BC^2-2AC.BC\times\cos ACB}=143 \text{ rods.}$$

Hence, the dimensions of the field are $AB=143$ rods, $BC=154$ rods, and $AC=165$ rods.

This problem was proved indeterminate by A. H. Bell.